

# **COPD and the Geriatric Population**

## **A major and growing problem**

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**Medical Director of Respiratory Care**

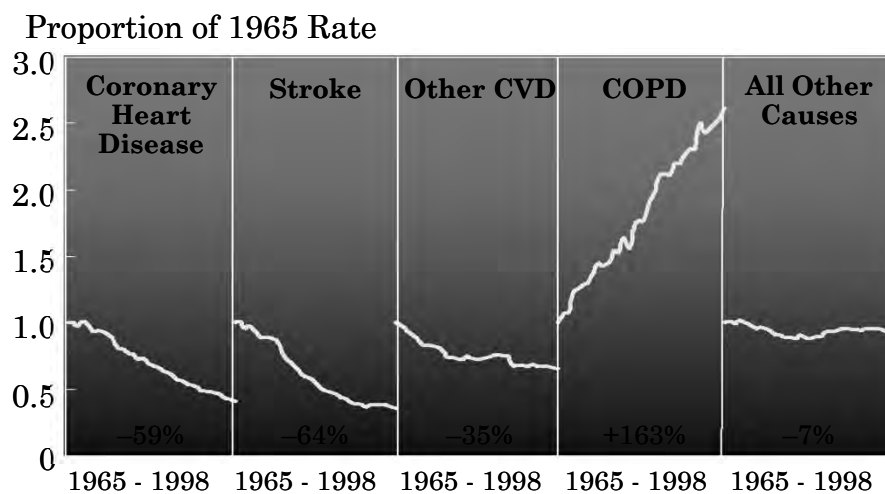
## **Lecture Topics and Format**

- **First 40 minutes**
  - *Scope of the problem*
  - *Current definition of COPD*
  - *Why geriatric patients are such a large fraction*
  - *Etiology of COPD*
  - *Questions*
  - *5 ' break*
- **Second 40 minutes**
  - *The Global Initiative for Obstructive Lung Disease (GOLD)*
  - *Treatment recommendations*
  - *Exacerbations of COPD*
  - *Questions*

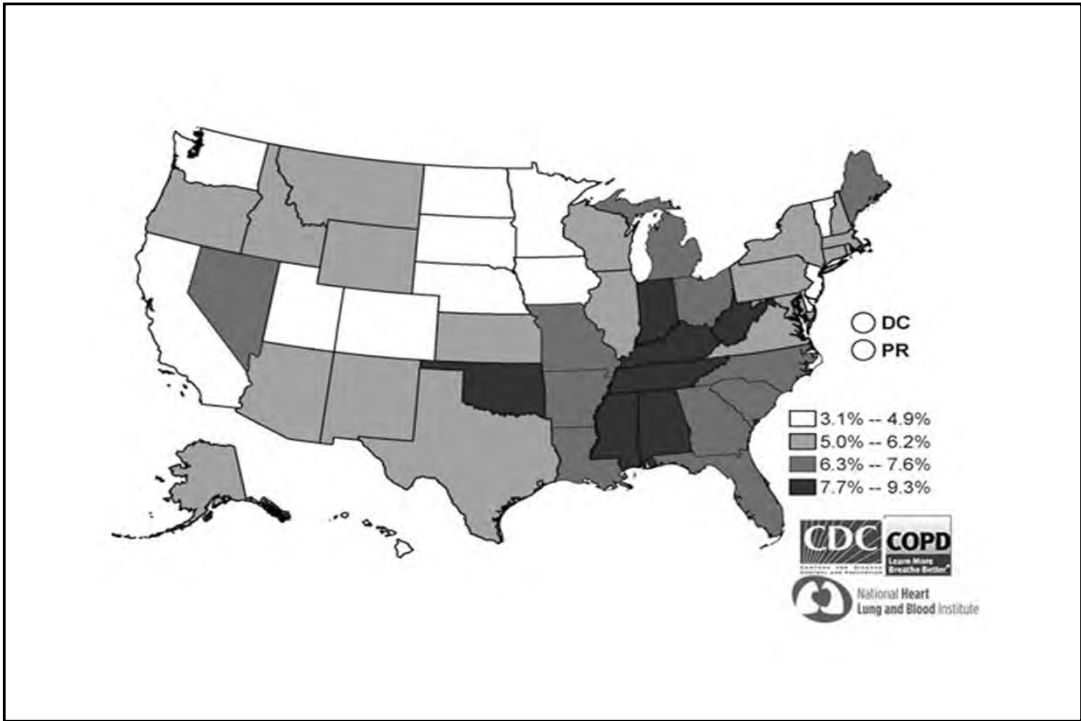
# COPD IS A BIG PROBLEM

- **As of 2014**
  - COPD affects 5% of the US population
  - Causes 120,000 deaths annually (3<sup>rd</sup> ranked)
  - Frequent office visits and resource utilization
  - European Union:
    - 6% of healthcare budget
    - 56% of cost of respiratory disease

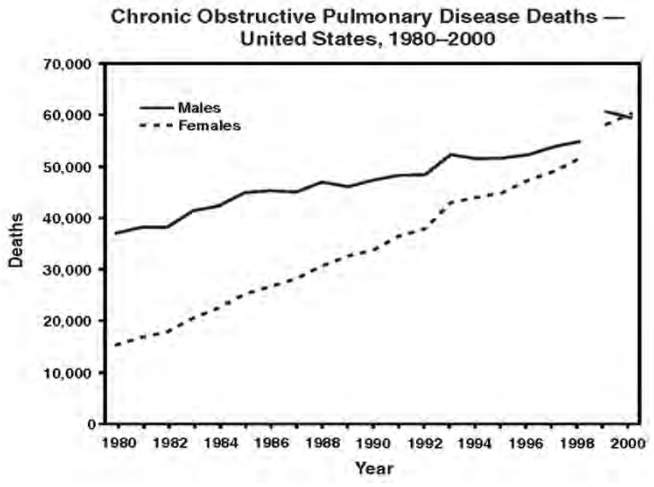
## Percent Change in Age-Adjusted Death Rates, US, 1965-1998



Reproduced with permission. GOLD Web site ([www.goldcopd.com](http://www.goldcopd.com)).



**2000 was the first year that the total number of COPD deaths was higher in women than men.**



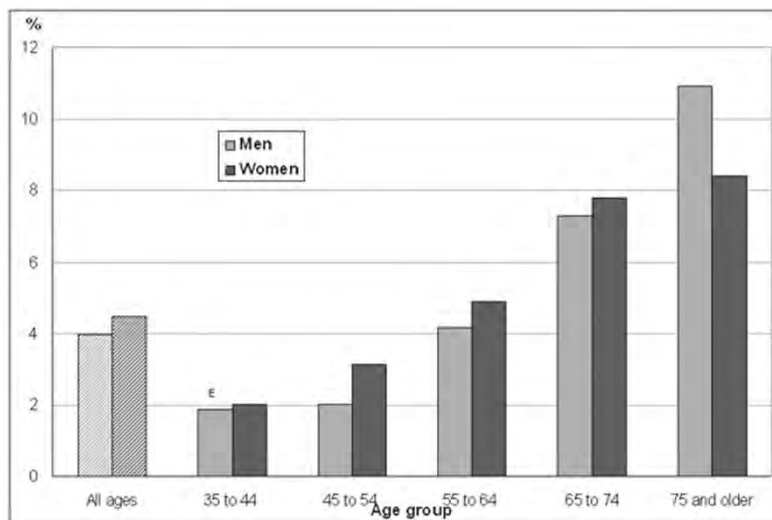
Reproduced from Mannino DM. *MMWR Surveill Summ.* 2002;51(6):1-16.

## Older Patients and COPD

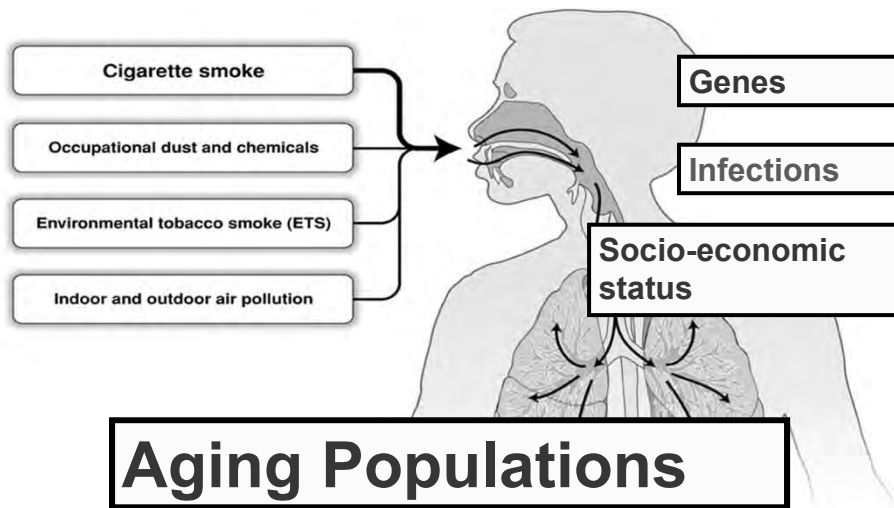
- As we age, the lung ages and airflow decreases giving lower reserve if additional airflow limitation occurs as in COPD.
- Cigarette smoke induced COPD takes decades to develop.
- COPD will predominantly affect older individuals.

## Canadian Population

The Lung Association. Lung Diseases, COPD. <http://www.lung.ca>

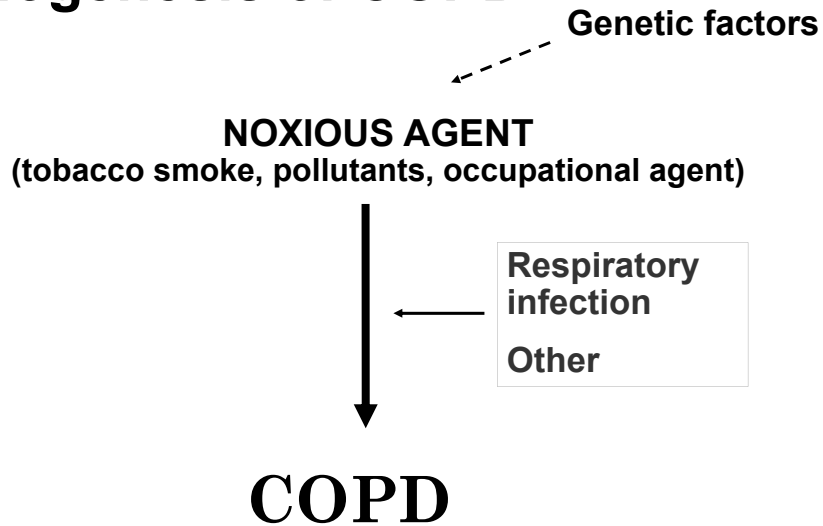


## Risk Factors for COPD



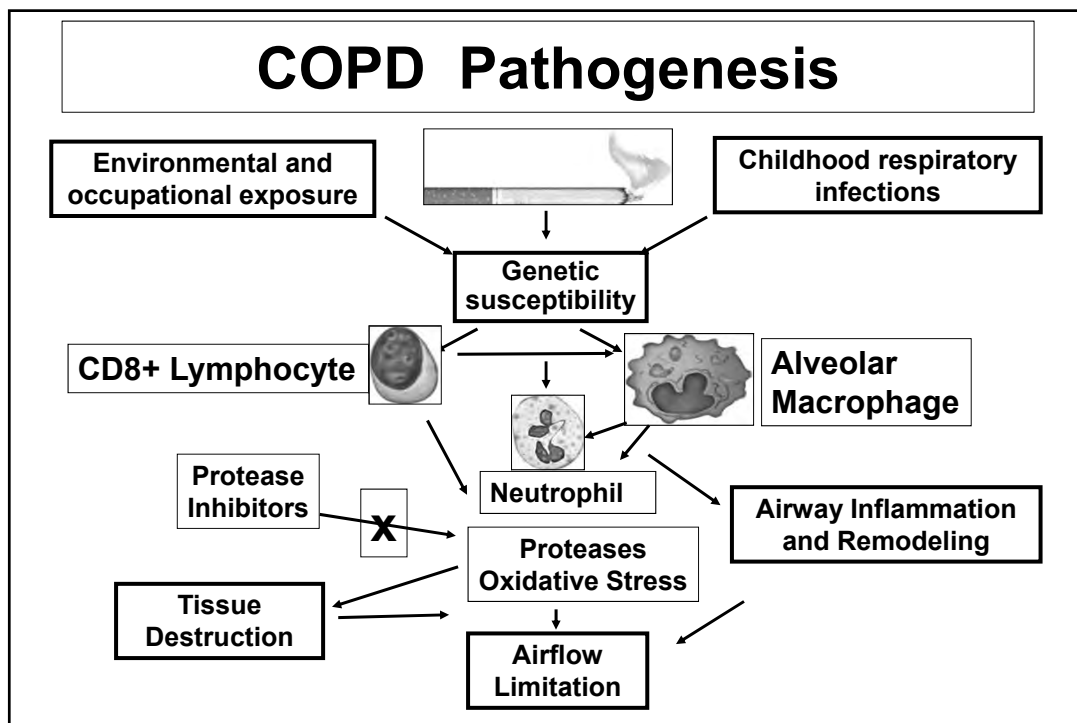
© 2015 Global Initiative for Chronic Obstructive Lung Disease

## Pathogenesis of COPD



NIH/NHLBI. *Global Initiative for Chronic Obstructive Lung Disease ("GOLD")*. April 2001. NIH Publication Number 2701. Updated July 2003, available at: [www.goldcopd.com](http://www.goldcopd.com).

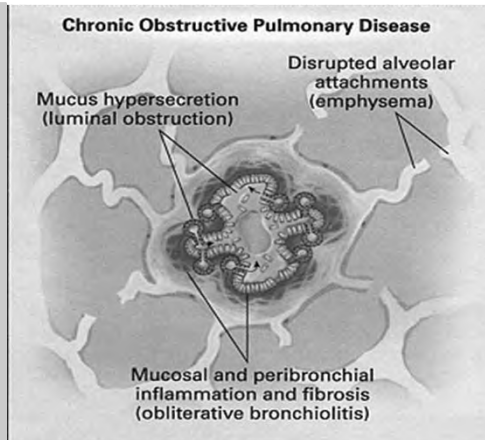
# Developing World *Etiology of COPD*



# COPD: Pathology

## STRUCTURAL CHANGES

Alveolar destruction  
Glandular hypertrophy  
Airway fibrosis



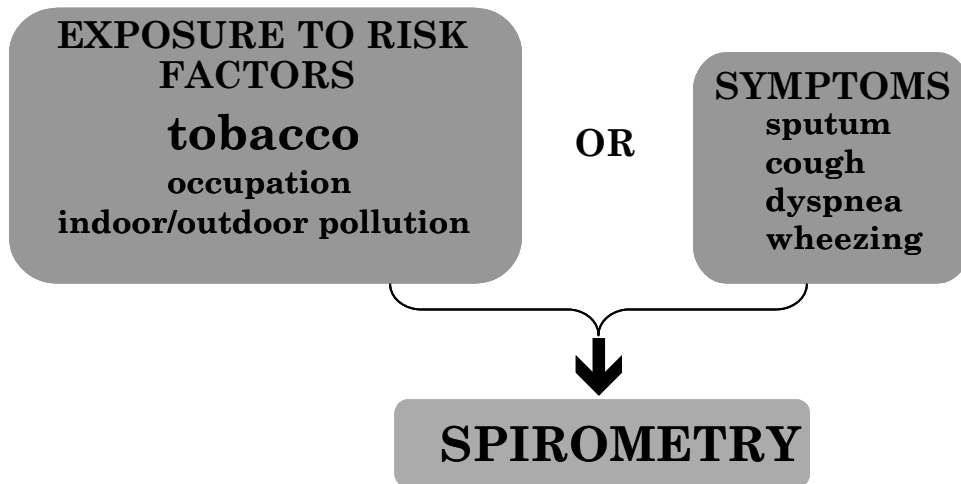
**Inflammation in COPD  $\neq$  Inflammation in Asthma**

Adapted with permission. Barnes PJ. *N Engl J Med.* 2000;343:269-80.

## Case: Does this patient have COPD ?

- **56 yo old male smoker comes in complaining of intermittent productive cough over the past 3 years. He was given and puffer in the past which he thinks may have helped.**
- **His CXR is reported to show “mild hyperinflation”.**

## Diagnosis of COPD



Adapted with permission from the GOLD web site. Available at: [www.goldcopd.com](http://www.goldcopd.com).

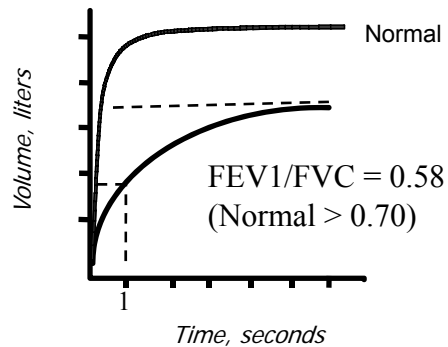
## COPD: Diagnosis

- **GOLD recommends a diagnosis based on formal measurement of lung function (spirometry) to establish diagnosis and classify disease severity**
  - $FEV_1/FVC < 0.70$  = airflow obstruction (normal  $FEV_1/FVC$  is age-dependent)
- **All persons over 45 years of age who have chronic cough and sputum production with a history of exposure to risk factors should be tested for airflow limitation, even if they do not have dyspnea**

*Global Initiative for Chronic Obstructive Lung Disease ("GOLD"). NIH/NHLBI; April 2001, updated July 2003. NIH Publication 2701. Available at: [www.goldcopd.com](http://www.goldcopd.com).*



## Spirometry necessary to diagnose COPD



## Mechanisms Underlying Airflow Limitation in COPD

### Small Airways Disease

- Airway inflammation
- Airway fibrosis, luminal plugs
- Increased airway resistance

### Parenchymal Destruction

- Loss of alveolar attachments
- Decrease of elastic recoil

**AIRFLOW LIMITATION**

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## Classification of Severity of Airflow Limitation in COPD

In patients with  $FEV_1/FVC < 0.70$ :

- GOLD 1: Mild             $FEV_1 \geq 80\%$  predicted
- GOLD 2: Moderate     $50\% \leq FEV_1 < 80\%$  predicted
- GOLD 3: Severe         $30\% \leq FEV_1 < 50\%$  predicted
- GOLD 4: Very Severe  $FEV_1 < 30\%$  predicted

*\*Based on Post-Bronchodilator  $FEV_1$*

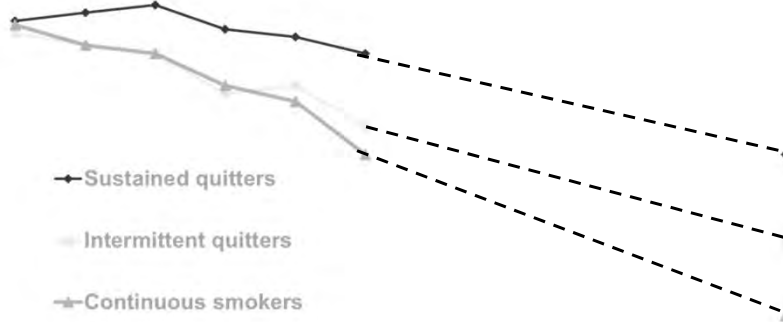
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## Therapy Based on Symptoms and Staging of COPD

Symptoms	Asymptomatic (Normal spirom)	Mild ( $FEV_1 > 80\%$ )	Moderate (50-80%)	Severe (30-50%)	Very Severe ( $FEV_1 < 30\%$ )
Staging	0 At Risk	I Mild	II Moderate	III Severe	IV Very Severe
	Avoidance of risk factor(s); influenza vaccination				
		<i>Add short-acting bronchodilators when needed</i>			
			<i>Add regular Rx c <math>\geq 1</math> long-acting bronchodilator. Add rehabilitation</i>		
				<i>Add ICS if repeated exacerbations</i>	
					<i>Add O<sub>2</sub> Consider surgery</i>

Adapted from NIH/NHLBI. Global Initiative for Chronic Obstructive Lung Disease ("GOLD"), Updated 2003. Available at [www.goldcopd.com](http://www.goldcopd.com).

## Smoking Cessation Slows Lung Function Decline in Mild COPD: The Lung Health Study at 11 Years



Data from Anthonisen NR et al. *Am J Respir Crit Care Med* 2002;166:675-9 as reported by Calverley PMA and Walker P. *Lancet* 2003;362:1053-61.

## Brief Strategies to Help the Patient Willing to Quit Smoking

- **ASK**                      Systematically identify all tobacco users at every visit
- **ADVISE**                Strongly urge all tobacco users to quit
- **ASSESS**                Determine willingness to make a quit attempt
- **ASSIST**                Aid the patient in quitting
- **ARRANGE**            Schedule follow-up contact.

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## Case- Treatment of COPD

- A 60 year old man comes to your office having been diagnosed with COPD. He is using an albuterol inhaler three times a day. His FEV1 is 54% predicted.
- Is his medication regimen adequate ?

## Therapy Based on Symptoms and Staging of COPD

Symptoms	Asymptomatic (Normal spirom)	Mild (FEV1 > 80%)	Moderate (50-80%)	Severe (30-50%)	Very Severe (FEV1 <30%)
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## Bronchodilator Medications for COPD

- **Inhaled B<sub>2</sub>-agonists**
  - Short acting beta<sub>2</sub>-agonists (SABA)
  - Long-acting beta<sub>2</sub>-agonists (LABA)
- **Inhaled Anticholinergics**
  - Short-acting anticholinergics (SAMA)
  - Long-acting anticholinergics (LAMA)
- **Inhaled combination short acting beta<sub>2</sub> and anticholinergics (SABA/LAMA)**
- **Inhaled combination long-acting beta<sub>2</sub> agonists and steroids (LABA/ICS)**
- **Inhaled corticosteroids (ICS)**
- **Phosphodiesterase IV inhibitors (PDE-4 inh)**
- **Methylxanthines (theophylline)**

## Inhaled short acting B<sub>2</sub> agonists (SABAs)

- **Albuterol (Proventil, Ventolin)**
- **Levalbuterol (Xopenex)**
  - R enantiomer of albuterol
  - Putative less B<sub>2</sub> side effects (controversial)
- **Use on an PRN basis**
  - If regular use, LABAs suggested
  - Reports of cardiac arrhythmias that are likely higher with regular use

## **Inhaled short acting anti-muscarinic agents (SAMAs)**

- **Ipratropium bromide (atrovent)**
- **Is equivalent to SABAs in controlled trials**
- **Is synergistic to SABAs in terms of lung function (combination agent)**
- **In head to head trials with older B<sub>2</sub> agonists improved FEV1 more**

## **Long acting B<sub>2</sub> agonists (LABAs)**

- ***Salmeterol (Serevent)***
- ***Formoterol (Foradil)***
- ***arformoterol (Brovana nebulized)***
- ***Indacaterol (Arcapta)***
  - **Once a day use**
- ***Vilanterol (available only in combination with LAMA)***
- **Similar to LAMAs when used alone**
- **Additive effects when used with LAMAs**

## Long acting Muscarinic antagonists (LAMAs)

- tiotropium (Spiriva)
- aclidinium (Tudorza)
- umeclidinium (Anoro –combined with LABA)
- glycopyrronium (Seebri-EU/Canada)
- Once daily
- Very effective in improving PFTs and sx
- Additive to effect of LABAs (may have greater impact on exacerbation risk)
- Cardiac side effects were questioned
  - TIOSPIR trial (17,000 + patients) no increase in mortality
- Urinary retention can occur

## Inhaled Corticosteroids ICS

- *Cochrane Database Syst Rev. 2012;7:CD002991*
- 55 Primary studies with 16,154 patients
  - Rate of COPD exacerbation reduced by 0.26 exacerbations per patient year.
  - Pneumonia risk increased OR 1.56 (95% CI 1.30-1.86)
  - Increased risk of oral candidiasis
  - Mortality rate not different
  - Change in FEV1 post-bronchodilator not different
  - Rate of bone loss no different.
- GOLD recommendation:
  - Add inhaled steroids with high risk of exacerbations

## **PDE-4 Inhibitors for COPD**

- **Prevent breakdown of cAMP in a variety of cells.**
- **Bronchodilation, anti-inflammatory and tissue remodeling effects.**
- **Bronchodilation is modest in effect**
- **Side effects: GI !! N/V/D and bloating. PDE-4 inhibitors may alter fibroblast activity in damaged lungs**
- **Specific PDE-4 inhibitors cilomilast and rolipram approved for use in the US.**
- **Recommendations vary: use where other agents ineffective**

## **Theophylline**

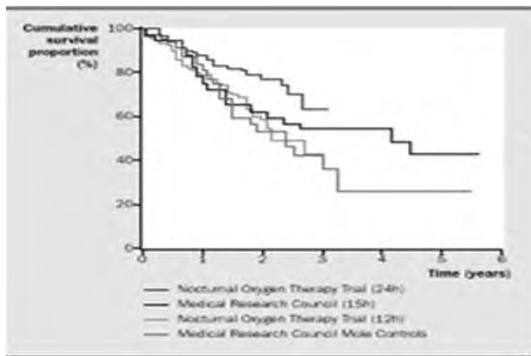
- **“The medication with a thousand lives”**
- **Cochrane Database Syst Rev. 2002**
  - **20 studies with oral theophylline**
  - **FEV1 increased 100 ml on average**
  - **Dyspnea decreased**
  - **? Increase in exercise tolerance**
- **Therapeutic level: 8-12 mcg/ml**
- **Toxicities are risk: cardiac arrhythmia and seizures**
- **Recommendations: add after “triple therapy”**



# Therapy Based on Symptoms and Staging of COPD

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## Oxygen Therapy

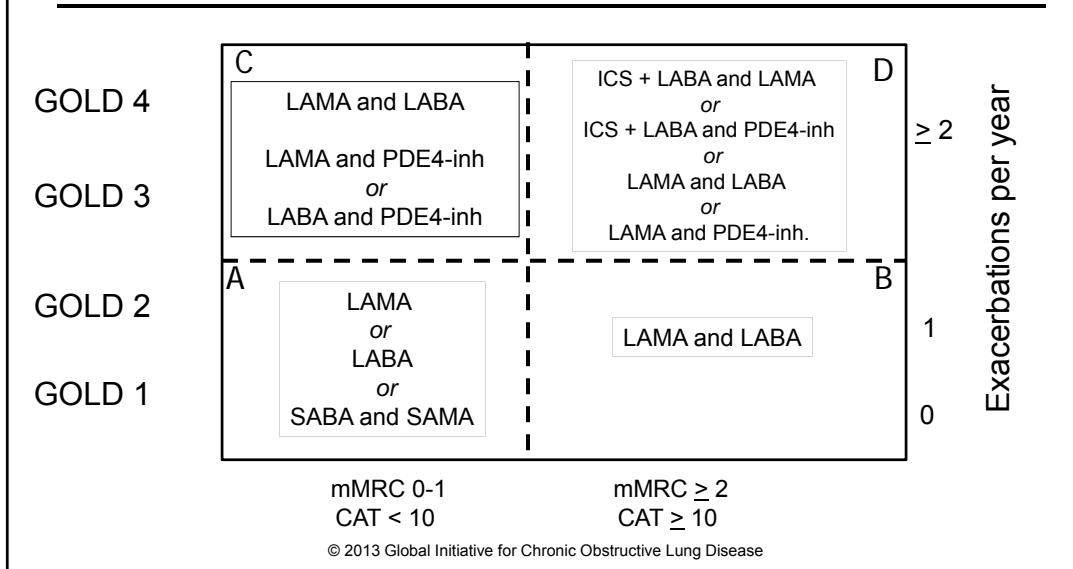
Oxygen should be prescribed if:

- PaO<sub>2</sub> < 55 mm Hg or Hgb sat < 88 %

or

- PaO<sub>2</sub> 55-59 mm Hg or Hgb sat < 89% if polycythemia, PAH, cor pulmonale present

Global Strategy for Diagnosis, Management and Prevention of COPD  
 Manage Stable COPD: Pharmacologic Therapy  
 ALTERNATIVE CHOICE



**Questions ?**

## **Definition of Acute Exacerbation (AE) of COPD**

- **A worsening of respiratory symptoms above baseline**
- **Anthonisen Classification**
  - **Type I**: Increase in dyspnea, sputum volume and sputum purulence
  - **Type II**: Increase in 2 of the above
  - **Type III**: Only one of the above but with cough, wheeze or URI sx

## **Etiology of AE COPD**

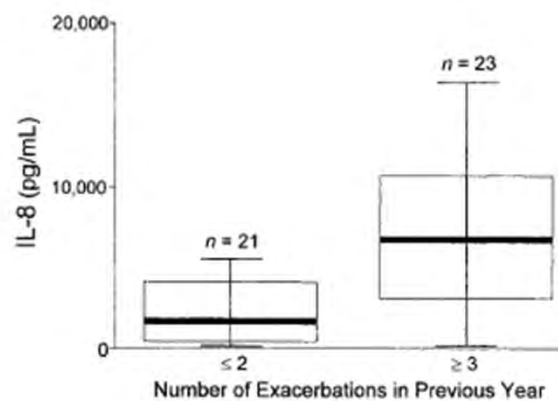
- **50% viral**
  - Majority due to rhinovirus
- **Bacterial infection 30 - 50%**
  - Colonization
  - Secondary infection
- **Non-specific triggers**
  - Air pollution
  - Weather

## Airway Inflammation and AE COPD

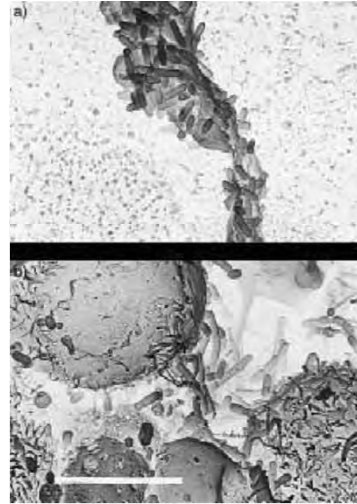
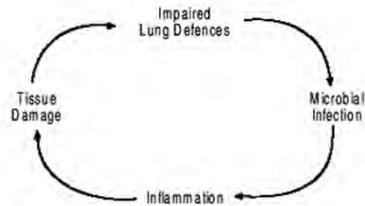
- Increase in inflammation with AE COPD
- Biopsy studies
  - Increases in PMNs, T lymphs and cells + for TNF-alpha.
- Patients with frequent exacerbations seem to show different inflammatory markers “inter-ictally”
- COPD specific anti-inflammatories in development

## IL-8 levels in AE COPD

Bhowmik et al. Thorax 2000;55: 114.



# Inflammation-Bacterial Infection

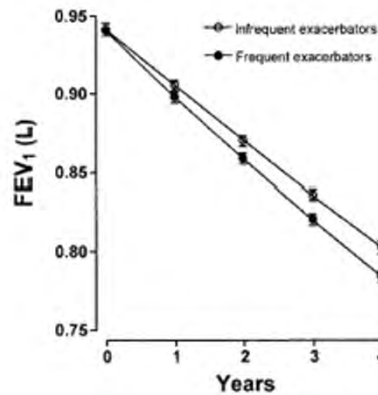


## Effects of AE COPD

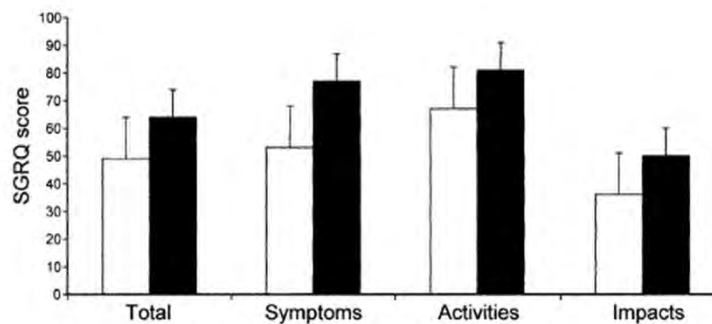
- Higher frequency in a given year predicts higher frequency the next year
- More rapid worsening of lung function
  - Contributes perhaps 25% to decline in function

# AE COPD and Progression of Disease

Donaldson et al. Thorax 2002;57:847.



## Effects of Exacerbation



- **Quality of life markedly impaired**
  - Wedzicha et al Am J Resp Crit Care Med 1998: 157:1418.

## **ED Evaluation of AE COPD**

- **HISTORY:**
  - Sputum amount and increase
  - Sputum color change
  - Dyspnea
  - Wheezing, cough, fever
- **Physical Exam:**
  - Tachypnea, tachycardia, fever
  - Excess work of breathing: accessories, intercostal retractions, abdominal paradox (diaphragm fatigue)

## **ED Evaluation of AE COPD**

- **LAB:**
  - CXR
  - ABG
  - Sputum sample
  - ABG
- **Admission**
  - Inadequate response to outpatient or emergency department management
  - Marked increase in dyspnea over baseline (eg, new onset resting dyspnea)
  - Severe underlying COPD (eg, forced expiratory volume in one second [FEV<sub>1</sub>] ≤50 percent of predicted)
  - Inability to eat or sleep due to symptoms

## **ED Evaluation of AE COPD**

- **Admission:**
  - New cyanosis or worsening hypoxemia
  - Acute or acute-on-chronic respiratory acidosis
  - Changes in mental status
  - Insufficient home support
  - History of frequent exacerbations
  - High risk comorbidities including pneumonia, cardiac arrhythmia, heart failure, diabetes mellitus, renal failure, or liver failure

## **Case – COPD Exacerbation Admission Medications**

- 72 year old female comes to the ER. She meets criteria for admission.
- You are writing orders for her admission. What COPD specific medications would you include ?



## **Medications for AE COPD admission**

- **Short acting bronchodilators**
  - SABA and SAMA can be used simultaneously
- **Steroids**
  - Parenteral (30-60 mg prednisone equivalent daily)
  - UK uses 30-40 mg PO
- **Abx:**
  - Increased sputum volume or color change
  - Signs of infection

## **Steroids in AE COPD Management**

- **Reduce inflammation**
- **Improve B-agonist response**
- **Speed resolution and decrease hospital stay**

## **Noninvasive Ventilation for Acute Exacerbations of Chronic Obstructive Pulmonary Disease**

Brochard et al. NEJM Volume 1995; 333:817-822

- **Does noninvasive ventilation in acute exacerbation of COPD reduce the rate of intubation ?**
- **French randomized-controlled multi-center trial**

## **Standard Treatment Group**

Brochard et al. NEJM Volume 1995; 333:817-822

- **Meds:**
  - antibiotics
  - bronchodilators
    - SQ terbutaline
    - aerosolized and IV albuterol
    - IV corticosteroids, aminophylline or both
- **O2 at up to 5 LPM to maintain Hgb sat > 90**
- **Correct electrolyte abnormalities**
- **Same medication regimen as control group**

## **NIPPV Treatment Group**

Brochard et al. NEJM Volume 1995; 333:817-822

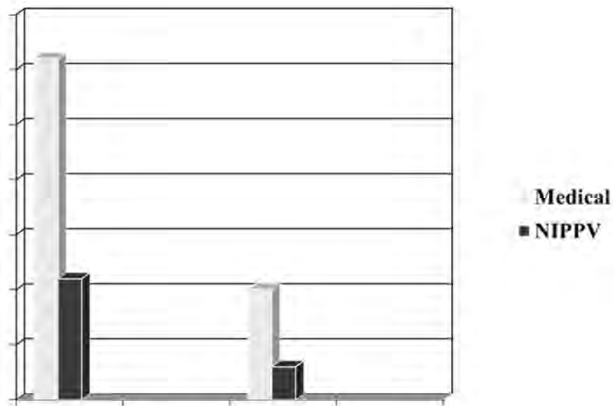
- **All used same ventilator and patient interface**
  - Pressure support ventilator
  - initially adjusted at IPAP 20 cm
  - O<sub>2</sub> provided to keep Hgb sat > 90 %
- **Six hours per day at least, period lengthened as tolerated, at least two hours per day break**

## **Criteria for Intubation**

Brochard et al. NEJM Volume 1995; 333:817-822

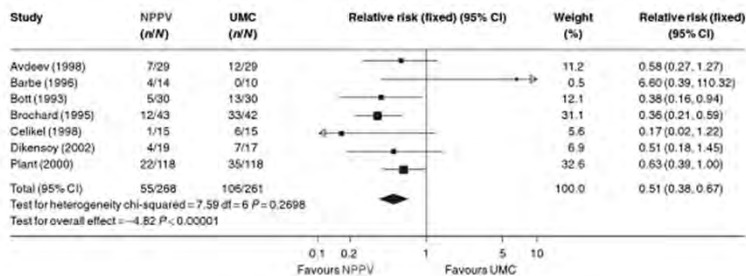
- **Major Criteria**
  - Respiratory Arrest
  - Respiratory pause with unconsciousness or gasping for breath
  - Sys BP < 70, HR < 50 with loss of alertness
  - uncontrollable psychomotor agitation
- **Minor criteria**
  - pH < 7.30, PaO<sub>2</sub> < 45 despite O<sub>2</sub> Rx
  - Increasing encephalopathy
- **Admission: 1 major 1 hour- 2 minor**

# Brochard Data



## Cochrane Database Systematic Review

- Multiple RCTs found
- Results:
  - Reduction in mortality: RR 0.52
  - Decreased need intubation: RR 0.41
  - Reduction in treatment failure: RR 0.48



## Patient Selection

- Evidence of respiratory muscle fatigue/failure
- Alert and co-operative patient (except COPD with CO<sub>2</sub> narcosis).
- Hemodynamic stability.
- No absolute need for tracheal intubation
  - airway protection
  - impaired swallow
  - inability to handle with secretions
- No acute facial trauma.
- Properly fitted mask.

## Monitoring of Patient During NIPPV

- Response
  - Clinical parameters
  - Oximetry
  - Exhaled VT
  - ABG
- Mask Fit
  - leak
  - avoidance of facial necrosis
- Gastric Distension

## Masks



## Dedicated Hospital Noninvasive hospital



## Candidates for NPPV

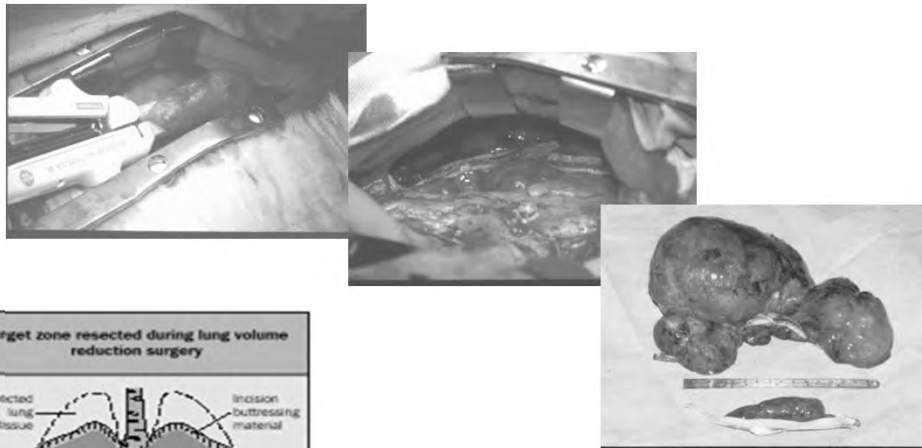
- **Indications:**
  - COPD exacerbation
  - Dyspnea with PaCO<sub>2</sub> > 45mm or pH < 7.30
  - Experienced respiratory therapists
- **Contraindications:**
  - Severe acidosis
  - e.g. cardiac ischemia, GI bleeding
  - Facial trauma
  - Patient non-cooperation

## Benefits

- **Full face mask**
  - More effective ventilation
    - Avoids leak
  - Better patient adherence
  - More comfortable short-term
- **Hospital Bilevel Machine**
  - Up to 40 cm inspiratory pressure
  - Graphics can allow identification of ventilator patient dyssynchrony
  - Most common difficulty: inspiratory flow rate not adequate (shorten rise time)

# Surgical Options for Advanced COPD

## Lung Volume Reduction Surgery

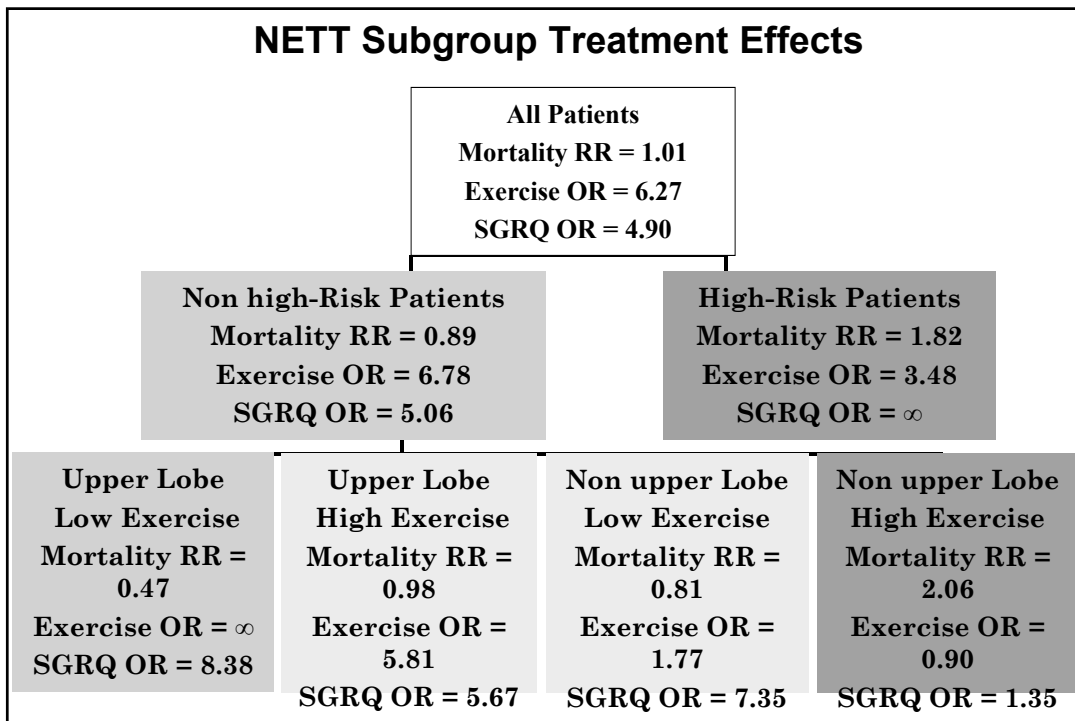




## Candidates for LVRS

- Moderate to severe COPD
  - FEV1  $\leq$  45 %
  - RV  $\geq$  150%, TLC  $\geq$  100%
- Emphysema on CT
- Significant impairment of QOL from sx
- Lack of co-morbidities

## NETT Subgroup Treatment Effects



# COPD and Lung Transplantation

- **Indications:**
  - **Severe Disease with symptoms**
    - **FEV<sub>1</sub> ~ 25%**
    - **Higher FEV<sub>1</sub> if rapidly progressive, disabling symptoms, secondary effects (PAH, cor pulmonale, etc)**
  - **Age < 65 years**
  - **Lack of co-morbidity**
- **Significant improvement in quality of life. Similar survival.**
- **Current major impediment bronchiolitis obliterans syndrome**
  - **Probably chronic rejection**
  - **Developments in rejection medications**

## Summary

- **COPD is a rapidly growing problem**
- **Smoking cessation is crucial to disease prevention and modification**
- **Medications are largely for symptom relief but some agents can reduce exacerbations**
- **Oxygen where needed is life-prolonging**
- **Noninvasive ventilation for AE is helpful**
- **Lung reduction surgery and lung transplant are options in very advanced disease**